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Woody Plants and their Ethnomedicinal uses by Tribal Communities of the Northern Balochistan, Pakistan

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Abstract
The relation between plants and man is immemorial old as his hunger, and long before the science was born. The medicinal uses of plants for the treatment of various disorders are common practice in many parts of the world. The ethnobotanical information about the medicinal uses of woody plant species in Balochistan, Pakaistan was obtained from 112 informants through semi-structured interviews, rapid appraisal approach, open ended questionnaire and personal observations. The data was analyzed using quantitative values indices such as: Use value (UV), Fidelity level (FL), informant consensus factor (ICF), relative frequency citation (RFC) and Family importance value (FIV). A total of 67 woody plants belonging to 30 families were collected and identified. Family Rosaceae was dominated over other families by donating (9 species) with (FIV 20). These plants were often used as decoction (28%) and consumed internally (89%). Leaves of the woody plants were used most often. The highest use value and highest fidelity level was recorded for *Punica granatum* and high relative frequency of citation was calculated for *Ephedra intermedia* (0.23). The highest ICF (0.33) was calculated for gastrointestinal ailments. It was observed that there is a gradual loss of traditional knowledge about these plants in new generation and also a rapid loss of woody plant populations due to agricultural expansion, cutting of woody plants for fuel at large scale and seasonal drought. These preferred plants

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could be economically important if introduced in market and cultivated for commercial purposes and subjected to further studies related to chemical screening for their authenticity.

Keywords: Balochistan, Geo-ethnographical, Informant consensus factor, Relative frequency citation, Woody plants

Introduction

The relation between plants and man is immemorial old as his hunger, and long before the science was born, our ancestors studied the plants around them to meet their basic needs, which laid the foundation of civilization. (Chaturvedi and Dass, 2011). Since the traditional use of plants as a source of food and folk medicines based on the use of plants by the local communities has been practiced for centuries and travels through generations from older to younger ones (Ahmad *et al.,* 2014). In recent years, use of ethnobotanical information in medicinal plant research has gained considerable attention in segments of the scientific community (Heinrich, 2000; Ayyanar & Ignacimuthu, 2011), especially the Gymnosperms and woody plants have been looked at differently, and have received varying degree of attention and treatment at the hands of botanists.

Medicinal uses from woody plants for the treatment of various disorders are common practice in many parts of the world. Similarly, medicinal use of the woody plants were common in the study area due to the spread of Juniper forest in Ziarat, Kalat (Harboi), Harnai (Zarghoon ghar) Zhob (Chilghoza forest) other desert forests of Tamarix in the study areas as well as the remoteness and limited health care facilities. The people of the Balochistan still depends on the indigenous plant resources to treat various diseases from generations to generations especially by rural population and forest ethnic communities (Bibi et al., 2014 & 2015)

During the previous few decades there has been a growing curiosity in the study of remedial plants and their folk usage in the world (Nunkoo *et al.,* 2012; York *et al.,* 2011, 2012; Shrivastava, *et al.,* 2013; Kayani *et al.,* 2014) in various parts of Pakistan (Ahmad, 2014, Bano, 2014, Abbasi, 2013) and in Balochistan (Tareen, 2010; Qureshi 2012; Bibi *et al.,* 2014 & 2015), but very few attempts have been done on the medicinal uses of the woody plants (Khan and Khatoon, 2007; Jan *et al.,* 2009; Hussain *et al.,* 2006; Sher and Al_yemeni, 2011). However, all these studies were conducted qualitatively with a gap in quantitative ethnobotanical data analysis.

This study aims to document and assess the medicinal uses of woody plants of northern Balochistan, Pakistan. In specific, it aims to perform quantitative assessment of the documented data using quantitative indices used in ethnobotanical studies for the better understanding of the traditional knowledge of plants used by local people in area, such as relative frequency of citation (RFC), use value(UV), informant consensus factor (ICF), family importance value index (FIV) and fidelity level (FL). To the best of our knowledge this is the first report on the indigenous medicinal knowledge of woody plants of Balochistan province and also the first qualitative and quantitative study of woody plants in Pakistan.

Materials and Methods

Geo-ethnographical overview: Balochistan, province of Pakistan is by far the largest in size and the smallest in population. The province covers 34.7 million

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hectares, almost 44% of the country's land area, with a population of about 8 million people (12 persons per sq. km.). The province is in South-Western (220N to 320N, 660E to 700 E) Pakistan. About 80% of the area can be classified as inter-mountainous. The remaining 20% consists of flood plains and coastal plains. The important mountain ranges are Sulaiman, Toba-Kakar, Central Brahui, Kirthar, Chagai, Raskoh, central Makran and Makran coast. The climate of Balochistan is continental semi- arid Mediterranean, with annual precipitation varying from 200 to 350 mm and a variable proportion of this total fall as moisture of snow and rain in the midwinter period or as intense showers in summer. The uniform aridity (now here exceeding 400 mm on average annually, but in many parts as low as 50 mm annually) makes un-irrigated agriculture impossible (PDMA Balochistan, 2012), (Fig. 1).

The province is sparsely populated and least developed as compared to the other three provinces in the country. The Brahui and Pashto is used primarily in speech particularly in northern Balochistan, we found a large Brahui population in the district Noshki, Kalat and Mastung, while district Ziarat, Harnai and Zhob were dominated by Pashtoons. District Quetta of northern Balochistan, Pakistan is mix of Pashtoons and Brahuis. Other ethnic groups are Urdu, Balochi, Dehwari, Hindko, Persian, Punjabi and Sindhi. All ethnic groups residing in the area commonly speak Urdu with each other for communication. (Anonymous, 1997).

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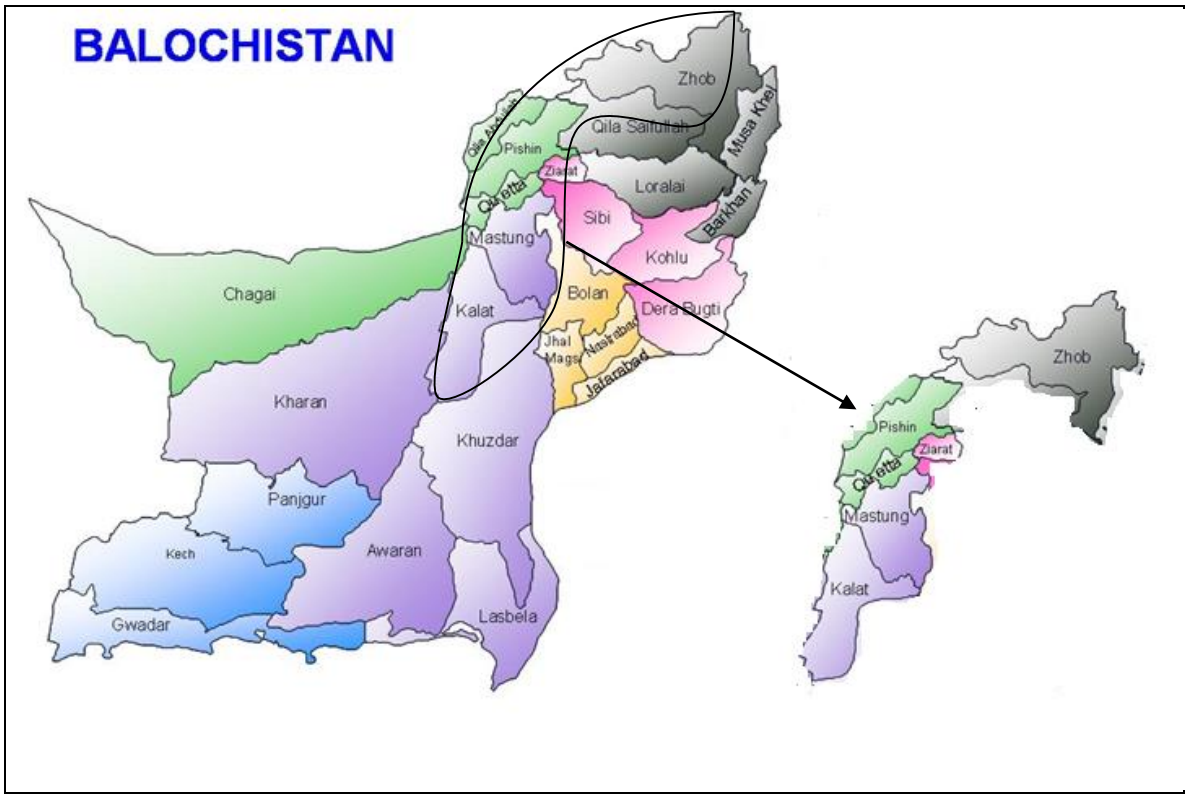

Fig. 1. Geographical location of the study area.

Socio economic conditions of the area

The Balochistan has blessed with diverse flora including a great number of medicinal plants. The rural areas of the Balochistan are still dependent on medicinal plants for their health care because of lack of health centers in the area. Agriculture is the major earning means of the people in the region. Nearly 50% of the population of Balochistan depends on agriculture. (Anonymous, 1997). If the sustainable use of wild flora and cultivation of medicinal plants are promoted in the area, this will strongly affect on the socio-economic condition of the local inhabitants.

Field interviews

Local medicinal plants practitioners and other knowledgeable people of the region such as elderly people, shepherds, farmers, herbalists, and medicinal herb vendors were among the interviewees. The information was collected through free listing interviews with randomly selected informants and field interviews with key informants selected after free listing (Ghorbani *et al.,* 2011). The questionnaire was mainly focused on the ethnomedicinal uses of woody plants by local communities. The interviews were conducted using the local language (Brahui, pashto and Urdu). Mrs. Tahira Bibi and Niaz Muhammad were aware with the local languages of the study area which permits the accuracy in data recordings. Ethno-botanical data was documented from local people and local Traditional Health Practitioners (THPs) including men and women of different age groups, educational level and experience of woody medicinal plants utilization (Table 1)
The number of informants for a species mentioning its uses was assessed and

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categorized (Amiguet *et al.,* 2005; Cook 1995). Information on vernacular names, medicinal application, herbal part(s) as pharmacological agent and mode of administration were recorded and presented with details in Table 2.

Collection and identification of medicinal plants. Ethno-botanical information about the medicinal uses of woody plant species in the study area were documented from seven localities i.e. Kalat, Noshki, Mastung, Quetta, Ziarat, Harnai and Zhob. The plants were collected from different parts of region. The collected plant specimens were dried, preserved and processed as per routine herbarium techniques recommended by Jain and Rao (1977). For authentic identification the Flora of Pakistan (Nasir and Ali, 1970-1979; Nasir and Ali, 1980-1989; Ali and Nasir, 1989–1991; Ali and Nasir, 1990–1992; Ali and Qaiser, 1992-2009) have been consulted. Reconfirmation of plants identification is done by consulting the Flora of Pakistan Tropicos (www.tropicos.org /Project/Pakistan). The verification of correct plant names is done from International Plant Names Index (IPNI: http://www.ipni.org) and The Plants list (http://www.theplantlist.org/) and then submitted to the Herbarium (ISL) of Quaid-i-Azam University Islamabad for future references.

Calculations. The data collected was analyzed using various quantitative value indices like ICF, FIV, FL, RFC, UV and UR.

Informant consensus factor (ICF). Informant Consensus factor (ICF) was used to test the homogeneity of knowledge on the use of species in the illness categories between the populations and obtained (Trotter and Logan, 1986; Heinrich *et al.,* 1998) by using the following formula:

$ICF= N_{ur}\_N_t/(N_{ur}\_1)$

Where Nur refers to the total number of use reports for each disease category and Nt is the number of taxa used in that category. The ICF provides a range of (0–1). High ICF shows that there is a narrow well-defined group of species used to cure a particular ailment category and/or that information is exchanged between informants and low ICF values (close to zero) indicate that informants disagree over which plant to used due to random choosing or lack of exchange of information about use among informants (Gazzaneo *et al.,* 2005)

Fidelity level (FL). (FL) Fidelity Level index was calculated to determine the most preferred species used in the treatment of a particular ailment as more than one plant species are in treatment in the same category; by using the following formula (Friedman *et al.,* 1986)

$FL= (N_p/N\times100)$

Where Np is the number of informants citing the use of the plant for a particular illness and N is the total number of informants citing the species for any illness. High FL value indicates high frequency of use of the plant species for treating a particular ailment category by the informants of the study area.

Relative frequency citation (RFC). The RFC of the species of plants being utilized was evaluated by using the formula proposed by Vitalini *et al.* (2013):

$RFC = FC/N$

FC is the number of informants who mentioned the species while N is the total number of informants participating in the study. RFC value varies from 0 (when

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nobody refers to a plant as a useful one), to 1 (when all the informants mentioning it as useful). RFC index, which does not consider the use-category (UR or use-report is a single record for use of a plant mentioned by an individual).

Use value (UV) and use report (UR). The Use Value (UV) demonstrates the relative importance of plants known locally. It was calculated by using the following formula (Phillips, 1994):

$$UV = \sum U/n$$

where UV is the use value of a species, 'U' is the number of use reports cited by each informant for a given plant species and 'n' is the total number of informants interviewed for a given plant. The UV is applied in determining the plants with the highest use (most frequently indicated) in the treatment of an ailment, while use report (UR) is the use recorded for every species.

Family importance value (FIV). Family importance value (FIV) was calculated by taking the percentage of informants mentioning the botanical family:

FIV= FC (family)/N ×100

Where, Fc is the number of informants mentioning the family while N is the total of informants participating in the study.

Results

A total of 67 ethnomedicinally important woody plants were collected and identified belonging to 30 families and 49 genera, of which 9 genera and 18 species are gymnosperms and 40 genera and 49 species are angiosperms (Table 2, Fig 2). Among families Rosaceae dominated over other families by donating 09 medicinal plant species followed by Pinaceae (07) and Ephedraceae (06) (Table 3). A total of 112 informants were interviewed and categorized into different demographic categories. It is recorded that there was 46% male informants including (39% common people and 7% Traditional health practitioners) and (54%) female informants. On the basis of age, the informants were classified into four major groups i.e. informants of less than 20 years (14%) 21-40 years (21%), 41-60 years (29%), above 60 years (36%) (Table 1).

Life form, parts used and herbal drug preparation methods of woody plants. The medicinal plant diversity shows that out of the 67 recorded woody medicinal plants, 18 species were gymnosperm and 49 species were angiosperm. In the woody plant species the trees are represented by 40 species and are found to be more prominent growth form than the shrubs (27 species) for treatment of various ailments. Among the most exploited parts of plants were leaves (26%) followed by fruits and bark (23%) while root is used very less i.e. (1%) only (Fig. 4).

Traditionally used plants are prepared and administrated in different ways. Of those reported in the study, 89% of plants were reported to be consumed only internally and 11% were reported to be use externally by informants (Fig. 2). .As far as internal consumption is concerned, the dominant form was decoction (30%), followed by powder (27%) and infusion (19%) (Fig. 3).

Use categories of woody medicinal plants: Woody plants species were used by the local inhabitants for curing different ailments. These ailments were grouped into 12 broad classes of diseases (Table 4). However, few ailments, such as "Others"

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(nutritive, tonic, brain tonic, bad evil eye, stimulant, swelling of body) didn't match with the classes of broad diseases and these were placed in a separate class (Other uses).

UR*= Use reports, UV*= Use value, FC*= frequency of citation, RFC*= Relative frequency of Citation

Table 3
Most numerously represented families.

Family Name	Number of genera	Number of species
Rosaceae	5	9
Pinaceae	4	7
Ephedraceae	1	6
Cupressaceae	3	4
Mimosaceae	4	4
Moraceae	2	3
Oleaceae	2	3
Salicaceae	2	3
Anacardiaceae	1	2
Aricaceae	2	2

Results of quantitative Analysis

The most common families as depicted by its FIV were Rosaceae as the dominant family with (20) FIV followed by Ephedraceae (17), Pinaceae (13), Cupressaceae (10), Mimosaceae (10) (Fig. 6). The least value of FIV were observed for Apocyanaceae, Convolvulaceae, Elaeagnaceae (2 each) followed by Meliaceae, Thymeliaceae (1 each) (Fig 5).

The use report and Use valve (UV) showed that *Punica granatum*, *Seriphidium quettense, Albizia lebbeck, Rosa indica* (5UR, 0.05UV each) are the most important woody species in the area in terms of medicinal use (Table 2).

The least use report Use valve (UV) were recorded for *Ephedra ciliata, Ephedra sarcocarpa, Melia azedarach, Prosopis glandulisa, Pyrus malus, Daphne* (1 UR, 0.01 UV each).

The results showed that ICF for Gastrointestinal diseases (astringent, flatulence, hernia, colic, digestion, diarrhea, dysentery, gastric, piles, purgative/laxative, stomachache, vermifuge, vomiting) have high ICF value of (0.33), followed by Respiratory diseases (Asthma, chest problems, cold, cough, expectorant, bronchitis, to keep warm the body) (0.24)) and Dermatological problems (ulcers, Beauty care, burns, Eczema, leprosy, wounds, emollient, demulcent, dandruff) (0.15). Least ICF were recorded for eye disease category (antimony, eye ointment), Infectious diseases (Malarial fever/ typhoid, refrigerant), Antidote (Snake bite, scorpion bite, insects bite), Gynecological problems (Delivery, pregnancy, menstrual), Blood circularity system disorders (Heart inflammation, anemia, Blood purifiers) (0) (Table 5).

Fidelity level (FL) of 11 woody plant species were found against a given ailment category (Table 4). Highest fidelity level were calculated for *Punica granatum* (95.2%) followed by *Pinus gerardianaa* (88.2%) and *Salvadora oleoides* (87.5%) (Table 5).

Based on the values of RFC, the most consumed medicinal plant species were *Ephedra intermedia* (0.233), *Rosa indica* (0.22) and *Phoenix dactylifera* (0.21) (Table 2). While, least values of RFC were represented by *Cycas revoluta* (0.047),

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Table 2
List of woody medicinal plants used by the local people of Balochistan and comparison of plants by using indices.

Family, scientific name, voucher specimen code	Local name (Pashto/ Brahui)	Life form	Part used	Disease treated	Preparation mode(s)	FC*	RFC*	UR*	UV*
Gymnosperms									
Cycadaceae *Cycas revoluta* Thunb. Q&SU: 401	Piti	Tree	Leaves seeds, bark	Nutritive, expectorant, tonic	Decoction, powder	5	0.05	3	0.03
Cupressaceae *Cupressus arizonica* Greene Q&SU: 402	Talai	Tree	Fruit, bark	Anthelmintic, astringent, backache, vomiting	Infusion/ Powder	15	0.13	4	0.04
Cupressus sempervirens L. Q&SU:403	Apurhs	Tree	Fruit, bark	Anthelmintic, astringent	Infusion/ Decoction	15	0.13	2	0.02
Juniperus excelsa M. Bieb. Q&SU:404	Apurhs/ Ubasht	Tree	Leaves, fruit, gum	Digestion, Cough, gonorrhea, diuretic	Powder, Decoction	21	0.19	4	0.04
Thuja orientalis L. Q&SU:405	Mora na parra	Shrub	Leaves, seeds	Vomiting, flatulence	Powder, Decoction	12	0.11	2	0.02
Ephedraceae *Ephedra ciliata* Fisch. & Mey. ex Mey. Q&SU:406	Oman/ Naromb	Shrub	Whole Plant	Avoid bad evil eye on day of wedding	Powder smoke	13	0.12	1	0.01
Ephedra gerardiana Wall. Ex Stapf. Q&SU:407	Mezh/ Naromb	Shrub	Whole Plant	Asthma, cough, heart diseases	Decoction, powder	19	0.17	3	0.03
Ephedra intermedia Schrenk & Meyer var. *tibetica* Stapf Q&SU:408	Narai Oman/ Naromb	Shrub	Whole Plant	Bronchitis, asthma, digestion, cough	Decoction, powder	26	0.23	4	0.04
Ephedra pachycalada Boiss. Q&SU:409	Oman/ Naromb	Shrub	Whole Plant	Bronchitis, asthma, digestion, cough	Decoction, powder	7	0.06	4	0.04

Pyrus communis (0.05) and *Pyrus malus* (0.04).

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Ephedra procera Aitch. & Hemsl Q&SU:410	Oman/ Naromb	Shrub	Whole Plant	Bronchitis, asthma, digestion, cough	Decoction, powder	13	0.12	4	0.04
Ephedra sarcocarpa Aitch. & Hemsl Q&SU:411	Oman/ Naromb	Shrub	Whole Plant	Bronchitis, asthma, digestion, cough	Decoction, powder	13	0.12	4	0.01
Pinaceae *Abies pindrow* Royle. Q&SU:412	Sada bahar	Tree	Leaves	Ulcers	Ash	8	0.07	1	0.03
Cedrus deodara (Roxb.ex Lamb) G. Don. Q&SU:413	Dayar	Tree	Leaves Bark	Kidney diseases, piles rheumatism	Powder, Decoction	11	0.01	3	0.02
Picea smithiana (Wall) Bois. Q&SU:414	Sada bahar	Tree	Bark, leaves	Cough, cold	Tea	6	0.05	2	0.02
Pinus gerardianaa Wall. Ex Lamb. Q&SU:415	Chalghoza/ Neza	Tree	Seeds	Stomachache, to keep warm the body in winters	Oil from crashed seeds	17	0.15	2	0.02
Pinus halepensis Mill. Q&SU:416		Tree	Gum	gonorrhea, diuretic	decoction	16	0.14	2	0.02
Pinus roxburgii Sargent. Q&SU:417	Chir, chil	Tree	Seeds, bark	Wounds, ulcers	Oil from crashed seeds	16	0.14	2	0.02
Pinus wallichiana A.B.Jackson. Q&SU:418	Nashtar	Tree	bark	Diaphoretic, stimulant	Decoction	17	0.15	2	0.02
Angiosperms									
Anacardiaceae *Pistacia khinjuk* Stocks. Q&SU:421	Gowan	Tree	Fruit, gum	Cough, cold, chest problems	Soup, Decoction, resin as chewing gum	15	0.13	3	0.03
P. atlantica Desf. ssp. *cabulica*. Q&SU:422	Katask	Tree	gum	Cough, Chest problems	Decoction, resin as chewing gum	12	0.11	2	0.02

Table 4
Percentage of species and citations in each medicinal use category.

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Apocyanaceae *Nerium oleander* L. Q&SU:423	Jor	Shrub	Leaves	Antidote, swelling of body	Decoction applied externally	16	0.14	2	0.02
Aricaceae *Nannorrhops ritchieana* (Griff.) Aitch Q&SU:424	Peesh/ Mazar	Shrub	Fruit, leaves	Tonic, astringent, dysentery	Raw fruits, Infusion	22	0.2	3	0.04
Phoenix dactylifera L. Q&SU:425	Khorma/ Ilar	Shrub	Fruit	Cooling of stomach, backache, tonic, chest problems,	Infusion, juice, Raw fruits	24	0.215	4	0.03
Asteraceae *Seriphidium quettense* (Podlech) Y.R.Ling Q&SU:426	Tarkha/ jir/ bootav	Shrub	Whole plant	Antidote, cough, young plant for stomachache, fever, chest problems	Ash, decoction	19	0.17	5	0.05
Berberidaceae *Berberis balochistanica* Ahrendt. Q&SU:427	Zarch/ Karwaskai	Shrub	Bark	Wounds, Ulcers, chest problems, bone fracture	Tea, Powder, Infusion	17	0.15	4	0.04
Buxaceae *Buxus papillosa C.* K. Schn. Q&SU:428	Shamshad	Shrub	Leaves, bark	Diabetes, purgative, rheumatism	Powder, decoction	11	0.1	3	0.03
Caesalpiniaceae *Cassia fistula* L. Q&SU:429	Amultaas	Tree	Leaves, seeds	Laxative, vermifuge, tonic	Powder, decoction	9	0.06	3	0.03
Capparaceae *Capparis deciduas* (Forssk.) Edgew. Q&SU:430	Kaler	Tree	Bark,	Laxative, flatulence, toothache	Powder, infusion	11	0.08	3	0.03
Chenopodiaceae *Haloxylon griffithii* (Moq.) Boiss. Q&SU:431	Bundi	Shrub	Whole plant	Young plant for stomachache, dysentery,	Decoction, powder	18	0.1	4	0.04

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				cough, toothache					
Convolvulaceae *Convolvulus leiocalycinus* Boiss. Q&SU:432	Tussko	Shrub	Whole plant	Purgative, diaphoretic	Decoction, Powder	13	0.16	2	0.02
Elaeagnaceae *Elaeagnus angustifolia* L. Q&SU:433	Sinjid	Tree	Fruit	Dysentery, cooling the stomach	Infusion	7	0.12	2	0.02
Euphorbiaceae *Ricinus cummunis* L. Q&SU:434	Bedangeer/ Bezazeer/ mazar panja	Shrub	Seeds, leaves	Laxative, Family planning, muscular pain	Raw seeds, Leaves	9	0.02	3	0.03
Papilionaceae *Caragana ambigua* Stocks Q&SU:435	Kirav pit	shrub	Whole plant	Diabetes, piles, purgative	Powder, decoction	12	0.11	3	0.03
Dalbergia sissoo Roxb. Q&SU:436	Jag	Tree	Bark, leaves	Astringent, gonorrhoea, diuretic, vomiting	Decoction, Powder	14	0.13	4	0.04
Fagaceae *Quercus robur* L. Q&SU:437	Ban	Tree	Fruit	Astringent, diuretic, gonorrhoea, digestion	Powder, infusion	10	0.09	4	0.04
Meliaceae *Melia azedarach* L. Q&SU:438	Bakain	Tree	Bark, leaves	Leprosy	Powder (external use)	16	0.14	1	0.01
Mimosaceae *Acacia modesta* Wall. Q&SU:439	Kikar	Tree	Bark, gum,	Diarreah, diabetes, astringent	Decoction, infusion	13	0.12	3	0.03
Albizia lebbeck L. Q&SU:440	Siris	Tree	Bark, Seeds	Piles, dirrhoea, dysentery, eczema, antidot	Powder, decoction	12	0.11	5	0.05
Mimosa hamata Willd. Q&SU:441	Pitti	Shrub	Leaves	Piles, burns, ulcers	Powder, infusion	9	0.09	3	0.03
Prosopis glandulisa Torr. Q&SU:442	Babur/ Babar/	Tree	Flower, Bark	Manstural problems	Powder,	8	0.03	1	0.01

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					decoction				
Moraceae *Ficus carica* L. Q&SU:443	Anjeer/ Injeer	Tree	Fruit	Laxative, tonic, demulcent, emollient	Infusion	20	0.18	4	0.04
Morus alba L. Q&SU:444	Toot/Thoot	Tree	Fruit	Laxative, cough	Infusion, juice, raw fruit	14	0.13	2	0.02
Morus nigra L. Q&SU:445	Shahtoot / Shehtoot / Tortoot	Tree	Fruit	Cough, chest problems, bronchitis	Infusion, juice, raw fruit	11	0.1	3	0.03
Oleaceae *Fraxinus xanthoxyloides* (Wall. ex Don) DC Q&SU:446	Bund	Tree	Bark, leaves	Diabetes, purgative, astringent	Decoction, powder	8	0.07	3	0.03
Olea europaea Q&SU:447	Zaitoon	Tree	Fruit	Laxative, demulcent, emolient	Infusion, decoctionn	9	0.08	3	0.03
Olea ferrugnea Royle Q&SU:448	Shawan	Tree	gum, Leaves	Antimoney from the gum, astringent, gonorrhea	Gum, Powder, Decoction	13	0.12	3	0.03
Platanaceae *Platanus orientalis* L. Q&SU:449	Chanar	Tree	Leaves, Bark	Hernia, dysentery, toothache, eye diseases	Powder (extenally for eyes and toothache), infusion	9	0.09	4	0.04
Punicaceae *Punica granatum* L. Q&SU:450	Anar	Tree	Fruit, leaves	Dysentry, Diarrhea, gastric, colic pain, to keep cool the eyes, Anemia, Stomachache	Powder, Infusion, Paste	21	0.19	7	0.06
Rhamnaceae	Pissi	Tree	Leaves, fruit	Chest problems,	Paste of mashed	12	0.11	3	0.03

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Zizipus spina-cristi (L.) Willd. var.*aucheri* Qaiser and Nazim Q&SU:451				cough, dandruf	leaves, decoction				
Rosaceae *Prunus brahuica* (Boiss.) Aitch. & HemslQ&SU:452	Mazhmonk/ Kunduri	Shrub	Whole plant, gum	Resin as eye ointment, astringent, stomachache	Infusion of resins, Powder	10	0.09	3	0.03
Cotoneaster pruinosa Klotz. Q&SU:453	Jangli cherry	Shrub	Fruit	Astringent, stomachache	Infusion	8	0.03	2	0.02
Prunus armenica L. Q&SU:454	Zardaaloo	Tree	Fruit (dried)	refrigerant, laxative	infusion	15	0.13	2	0.02
Prunus amygdalus L Q&SU:455	Badam	Tree	Seeds, seed coat	Brain tonic, ash of seed coat as tooth paste and antimony(surma) for eyes, fairness of face	Infusion, ash, paste of seeds with water	23	0.21	4	0.04
P. domestica L. Q&SU:456	Aaloo bukharaa	Tree	Fruit (dried)	refrigerant, stomachache	Infusion	16	0.14	2	0.02
P. persica (L.) Batsch Q&SU:457	Shaftaloo	Tree	Fruit	Purgative, beauty, tonic	Raw fruit	7	0.06	3	0.03
Pyrus communis L. Q&SU:458	Nak/ nashpati	Tree	Fruit	Astringent, headache	Raw fruit	5	0.05	2	0.02
Pyrus malus L. Q&SU:459	Sof, saib	Tree	Fruit (pericarp in dried form)	Headache	Tea	4	0.04	1	0.01
Rosa indica L. Q&SU:460	Gulgulap / gulab	Shrub	Flower	Laxative, gastric, colic pain, beauty/ fair face, to cool the eyes	Infusion, Powder	25	0.22	5	0.05

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Salicaceae *Populous alba* L. Q&SU:461	Ispedar, sufaida	Tree	Leaves, bark	Beauty, blood purifier, tonic	Powder, decoction	12	0.11	3	0.03
Salix acmophylla Boiss. Q&SU:462	Gait	Tree	Bark	Tonic, astringent	decoction	11	0.1	2	0.02
Salix alba Q&SU:463	Tali	Tree	Leaves, bark	Rheumatism, diarrhea, dysentryastringent	Decoction	13	0.12	4	0.04
Salvadoraceae Salvadora oleoides Decne. Q&SU:464	Kabbarh	Shrub	Leaves, root, fruit, seeds	Purgative, rheumatism, to keep warm the body after deleivery, chest problems	Decoction, powder	16	0.14	4	0.04
Sapindaceae *Dodonaea viscose* (L.) Jaq. Q&SU:465	Anartrik	Shrub	Flower, leaves, bark	Rheumatism, ulcers, wound, astringent	Powder, Decoction externallyused)	19	0.17	4	0.04
Stocksia brahuica Bent. Q&SU:466	Koh tor	shrub	flower	Fever, pugative, wound, ulcers	Powder, infusion	17	0.15	4	0.04
Tamaricaceae *Tamarix. karelini* Bunge. Q&SU:467	Ghaz/ Kirri	Shrub	Leaves, bark	Chest problems, cough, astringent	Decoction	14	0.13	3	0.03
T. szovitsiana Bunge. Q&SU:468	Ghaz/ Kirri	Shrub	Leaves, bark	Diarrhea, cough, ulcers, wounds	Decoction, Powder	13	0.12	4	0.03
Thymeliaceae *Daphne mucronata* Royle Q&SU:469	Zahr booti	Shrub	leaves	Cancer wounds	Decoction	10	0.09	1	0.1

S.No.	Disease category	No. of use reports	%age of use reports	No. of Species	%age of taxa used	Informant consensus factor (ICF)
1.	*Gastrointestinal diseases* (astringent,	70	35	47	34	0.33

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	flatulence, hernia, colic, digestion, diarrhea, dysentery, gastric, piles, purgative/laxative, stomachache, vermifuge, vomiting)					
2.	*Respiratory diseases* (Asthma, chest problems, cold, cough, expectorant, bronchitis, to keep warm the body)	39	20	22	16	0.24
3.	*Dermatological problems* (ulcers, Beauty care, burns, Eczema, leprosy, wounds, emollient, demulcent, dandruff)	24	12	13	10	0.15
4.	*Musculoskeletal disorders* (bones fracture toothache, rheumatism, backache, muscular pain, headache, dislocation)	17	9	15	11	0.02
5.	*Others* (nutritive, Tonic, brain tonic, bad evil eye, stimulant, swelling of body)	15	7	10	7	0.07
6.	*Urogenital problems* (diuretic, kidney pain, gonorrhea,)	10	5	6	4	0.05
7.	Glandular disorders (diaphoretic, Diabetes)	8	4	6	4	0.02
8.	*Eye diseases* (antimony, eye ointment)	7	3	7	5	0
9.	Infectious diseases (Malarial fever/ typhoid, refrigerant)	4	2	4	3	0
10.	*Antidote* (Snake bite, scorpion bite, insects bite)	3	1	3	2	0
11.	*Gynecological problems* (Delivery, pregnancy, menstrual)	3	1	3	2	0

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12.	Blood system disorders (Heart inflammation, anemia, Blood purifiers)	circularity	3	1	3	2	0

Table 5. Fidelity level (FL) of ethnomedicinal plants of the study area.

S.No.	Plant Name	No. of informants reported the taxa	No. of ailments treated	No. of use most frequently determined by informant	FL
1.	*Punica granatum* L.	21	7	20	95.2
2.	*Pinus gerardianaa* Wall. Ex Lamb.	17	2	15	88.2
3.	*Salvadora oleoides* Decne	16	4	14	87.5
4.	*Seriphidium quettense* (Podlech) Y.R.Ling	19	5	16	84.2
5.	*Juniperus excelsa* M. Bieb.	21	4	17	80.9
6.	*Ephedra intermedia* Schrenk & Meyer	26	4	21	80.8
7.	*Phoenix dactylifera* L.	24	4	19	79.2
8.	*Convolvulus leiocalycinus* Boiss.	13	2	10	76.9
9.	*Haloxylon griffithii* (Moq.) Boiss.	18	4	13	72.2
10.	*Rosa indica* L.	25	5	18	72
11.	*Berberis balochistanica* Ahrendt.	17	4	12	70.6
12.	*Stocksia brahuica* Bent.	17	4	11	64.7

Discussion

It is noted that women have slightly more information about medicinal plants than men, reflecting their roles in household management and child care as well as their leading role in keeping families and communities generally healthy by providing preventive care and treatment. (Abe and Ohtani, 2013). Women have long been associated with herbal healing because of their crucial role in plant diversity management and conservation at the household, village, and community levels (Braidotti *et al.,* 1994). Additionally, those aged over 60 were more knowledgeable than their juniors and the use of medicinal plants decreased with decreasing age. Similar results were stated in the studies conducted in Ethiopia (Giday *et al.,* 2009; Gedif and Hahn 2003), Thailand (Wester and Yongvanit 1995) and in Pakistan (Ahmad *et al.,* 2014 and Kayani *et al.,* 2014). Although almost all informants

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reported that knowledge of medicinal plants was inherited from their ancestors through oral tradition, the number reporting this varied by age, which means that knowledge of the use of medicinal plants may be disappearing.
The medicinal plant diversity shows that the trees are found to be more prominent growth form than the shrubs for treatment of various ailments. Similarly Khan and Khatoon (2004) found trees as dominant life form during an ethnobotanical studies on useful trees and shrubs of Haramosh and Bugrote valleys, in Gilgit northern areas of Pakistan. The frequent use of trees among the indigenous communities may be due to the rich wealth of juniper forest, Chilghoza forest and other deserts like "Tamarix forest desert" in the area.
Traditionally used plants are prepared and administrated in different ways. The oral mode of administration is dominate over the topical mode of preparation (Mood 2008; Brandao *et al.,* 2012). Topical applications included ointments, oil extracts and smoke, applying ash, antimony. While decoction is the most commonly used preparation method, followed by infusion in study area. Nasab and Khosravi (2014) also reported that Plants are often used as decoction (28%) and as powder (21%) in Sirjan Iran. Ahmad *et al.,* (2014) reported decoction was the most commonly used preparation method, followed by infusion in Chail valley. It is noticed that a number of herbal preparations are taken with milk or honey; however, water is the dominated supporting agent with herbal medicine. These herbal medicines are used for curing different ailments. The highest number of species used in treatment of gastrointestinal diseases (34%) and respiratory ailments (16%) (Table 4). Ullah *et al.,* (2013) conducted a similar study in Wana district in Pakistan, by the use of medicinal plants for the treatment of gastrointestinal disorders had a high prevalence. Similar results were recorded by (Bano *et al.,* 2014) and the predominance of remedies for digestive system disorders also agrees with the data from other regions (Jaric´ *et al.,* 2007; Menkovic´ *et al.,* 2011; Nasab and Khosravi, 2014). This is consistent with the statement that traditional phytopharmaceutical products are usually limited to the treatment of mild and chronic diseases (Reuter 1991). While least percentage were found in antidote, Gynecological problems and Blood circularity system disorders. (Nasab and Khosravi 2014).
The ethnic populations in northern Balochistan Pakistan utilized mostly leaves for the preparation of herbal medicines. Leaves were also reported as dominant plant part utilized by different ethenic communities in the world (Srithi *et al.,* 2009; Giday *et al.,* 2010; Ignacimuthu *et al.,* 2006, 2008; Mahishi *et al.,* 2005; Cakilcioglu and Turkoglu, 2010; Gonzalez *et al.,* 2010). The object why leaves were used mostly is that they are gathered very effortlessly than underground parts, flowers and fruits etc. (Giday *et al.,* 2009) and in logical point of view leaves are vigorous in photosynthesis and production of metabolites and production of metabolites (Ghorbani, 2005) the frequent use of leave, fruit and bark and least use of root of woody plants may be due to that it is not possible for the people to collect the roots of large trees and shrubs but it is very easy to collect the leaves or fruits from the larger plants (Kayani *et al.,* 2014).

Quantitative Analysis

Relative frequency citation (RFC). RFC was calculated to ascertain the most common occurring woody medicinal plants used for cure of various diseases. RFC shows the local eminence of every species with reference to informants who cited

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these plant species (Vitalini et al., 2013 In our present work, RFC ranges from 0.04 to 0.23 (Table 2). The plants having high RFC such as *Ephedra intermedia, Rosa indica* and *Phoenix dactylifera* (Table 2).are predominantly used and commonly known by the local people. Reason for the high RFC may be wide distribution, easy availability and indigenous culture for treating various ailments by using these species. These results may be taken as most important for linking and evaluating research in related academic disciplines for future drug discovery and sustainable use of plants for therapeutic uses (Mukherjee and Wahile, 2006). The plant species having high RFC should be subjected to pharmacological, phytochemical and other biological studies to evaluate and prove their authenticity (Mukherjee *et al.,* 2012). Besides above, it should be prioritized for conservation as their preferred use may cause threats to their population by over harvesting.

Use value (UV) and Use report (UR). UV determines the relative prominence of species having more use reports indicated by local informants. In our present work it ranges from 0.01 to 0.05 (Table 2). The predominance of *Punica granatum, Rosa indica and Albizia lebbeck* can be explained by the fact that these are common and multipurpose species as they used for food, aromatic and medicinal purposes. It is found that plants having fewer UR reported by informants have low UV such as *Ephedra ciliata, Ephedra sarcocarpa, Melia azedarach, Daphne mucronata* having least use report as well least use vale (1 UR, 0.01 UV each). The reason of the low use reports and use value of *Ephedra ciliata, Ephedra sarcocarpa* may be that these plants are not easily available for the local people, these plants are now only restricted to the national parks or on high altitude, while in case of *Melia azedarach* and *Daphne mucronata* the local people are aware of the toxicity of, these species. They use these species for topical use only, like cancer wounds and leprosy and these both diseases are not common in the study area.

It is also observed that plants which are used in some repetitive manner are more likely to be biologically active (Trotter and Logan, 1986). Hence, the plants having the highest UR and UV values might be an indication of their good healing potential for specific ailments.

Although it was impossible to find a study area which exactly matched the points of comparison in our study, for instance a rough comparison for UV and UR and FIV were made with the results of other studies, For example, in the study by (Abbasi *et al.,* 2013) *Ficus carica* and *Ficus palmata* were the most cited species. Bano (2014) reported as *Hippophae rhamnoides* has the highest use value (1.64) followed by *Rosa brunonii* and *Capparis spinosa* (1.47), while Kayani *et al.* (2014) reported least use value for the *Albizia lebbeck* (0.07). The differences may be due to variation in vegetation, climate and geographic area. The Use value is an important tool to select most valued medicinal plants of any region which further may be used for detailed pharmacological evaluation of medicinal plants.

Family importance value (FIV). The most common families of woody plant species as depicted by its FIV were Rosaceae as the dominant family followed by Ephedraceae, Pinaceae, Cupressaceae and Mimosaceae (Fig. 6). Family Rosaceae is also reported as dominant family in woody plants of Haramosh and Bugrote valleys, in Gilgit northern areas of Pakistan by (Khan and Khatoon, 2007). Kayani *et al.,* (2014) encountered the most common families in the Gallies-Abbottabad, Northern Pakistan were Asteraceae (14.2 % of usereports) followed by Solanaceae (6%), Apiaceae (5 %), Mimosaceae and Lamiaceae (4.2%).

Informant consensus factor (ICF). The consensus of informants on medicinal

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plants reported for treating different ailments was quantitatively analyzed. To develop this consensus, all treated diseases are grouped into12 categories. In current studies, ICF value ranges from 0.15 to 0.33. The highest ICF Value is found for gastrointestinal diseases and least ICF were recorded for 5 categories i.e. eye disease category, infectious diseases, antidote, gynecological problems, menstrual, blood circularity system disorders (Table 5). Our results are strongly agree with Jamila and Mostafa (2014) who reported the high ICF for these three categories respectively and least ICF for the plants used in vision problems and the eye and pathologies of the circulatory system .The low ICF value seen in our study for these problems could be due to a lack of communication among people in different areas of the multicultural study region and also the less distribution of woody plants in different regions. The high ICF values for this category indicates the reason able reliability of informants on the use of medicinal plants species (Lin *et al.,* 2002). Further high ICF is always allied with a few specific plants with high use reports for treating single disease category (Madikizela *et al.,* 2012). On the other hand, its low values are always associated with many plants with almost equal or high use reports suggesting the lesser level of agreement among the informants on use of plant species to treat a particular disease category.

Fidelity level (FL). The FL of plant species for treating specific diseases in the study area varies between 64 % and 95.2%. Highest fidelity level is recorded for *Punica granatum*, *Pinus gerardiana* and *Salvadora oleoides*. *Punica granatum* is mostly used for (gastrointestinal diseases) dysentry, diarrhea, gastric, colic pain and stomachache, while *Pinus gerardiana is used* to keep warm the body in winters and *Salvadora oleoides* is used to keep warm the body after deleivery and chest problems. These species may be proven as important medicinal plants on further evaluation through phytochemical, pharmaceutical and biological activities. We have recognized plants as more important having 80 FL% or more. Least fidelity level for *Stocksia brahuica* may be due to the narrow distribution of the species, which is found only in a single locality (Mastung) throughout the province. According to our findings we suggest that high FL indicates the prevalence of specific diseases in the area that are treated with the medicinal plants with high FL values.

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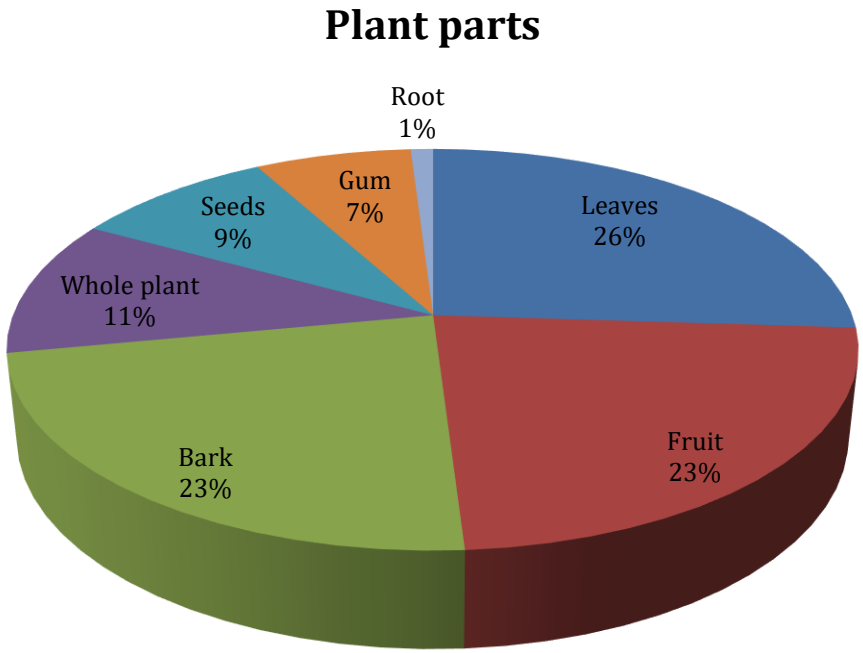

Fig. 2. Percentage of plant parts used for medicinal applications.

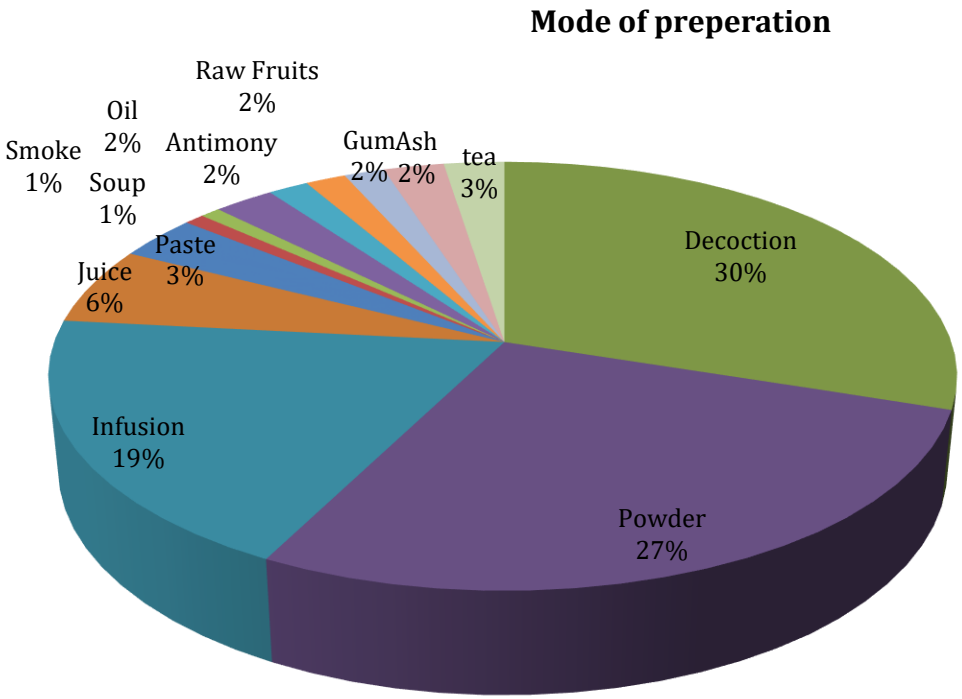

Fig. 3. Percentage of herbal drug preparation methods.

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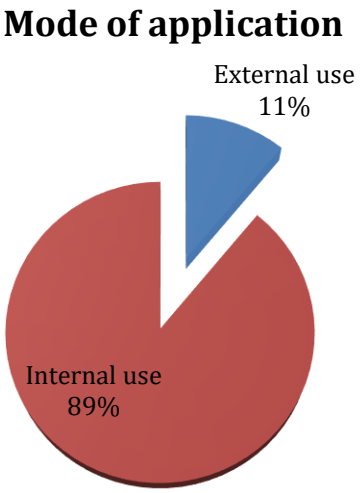

Fig. 4. Percentage of herbal drug mode of application.

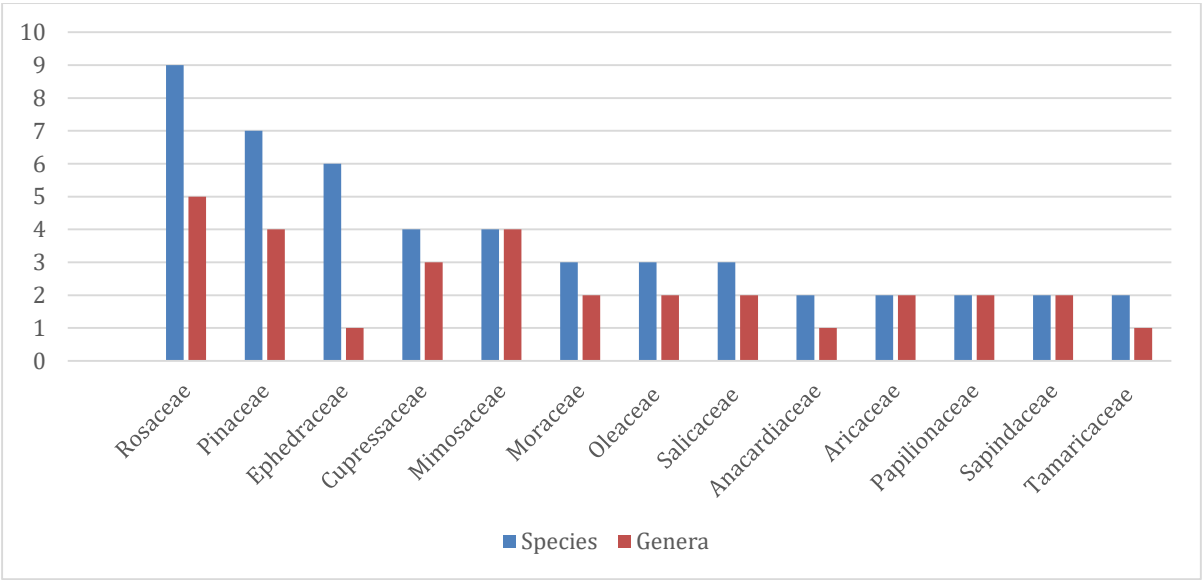

Fig. 5. Number of genera and species by family used for medicinal purposes in the study area.

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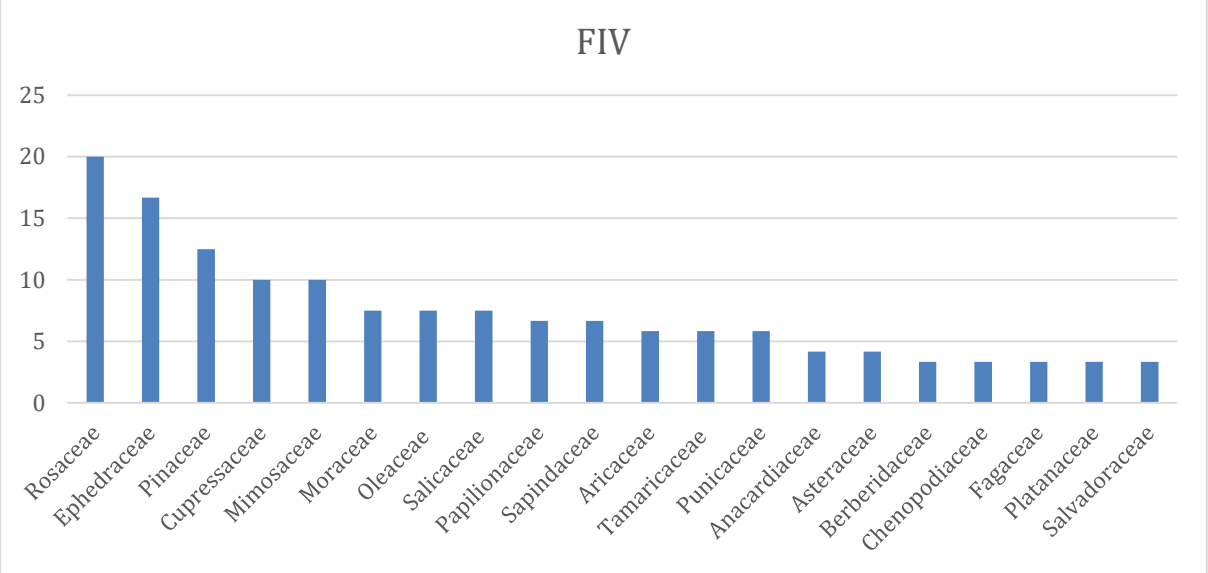

Fig. 6. Family Importance value (FIV) of woody medicinal plants in the study area.

Conclusion

This study presents the first qualitative and quantitative ethnomedicinal uses of the woody plant species of the Balochistan in seven selected sites. Among 67 plant species belonging to 30 reported families, Rosaceae and Pinaceae are the most used families in the area.

Quantitative analysis including the FL, RFC, ICF and use value (UV) was performed to evaluate the valued medicinal plants of the study area. ICF values indicated that there was high agreement in the use of plants in gastro intestinal ailment category among the users. Analysis of the data in terms of use value and informant consensus factor confirmed that the relative importance of species and sharing knowledge of herbal therapies between different tribal communities of this area is rich.

Meanwhile, we have compiled significant baseline data regarding indigenous knowledge about the native woody medicinal plants for treating common ailments is now ready to be further investigated phytochemically and pharmacologically such as: *Amygdalus brahuica Berberis balochistanica, Convolvulus leiocalycinus* which leads to natural drug discovery and development. As revealed from the current findings, it is suggested that these plants could be economically important if introduced in market and cultivated for commercial purposes.

Furthermore Agricultural expansion, cutting of trees for fuel at large scale pooled with seasonal drought is main factors in the reduction of woody medicinal plant populations of Balochistan. Practical steps should be taken immediately to ensure the inclusion of relevant flora within conservation designations for sustainable use. This would be meant to enhance the welfare level of the people of Balochistan.

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